

Preparing for IA-64 WHQL Submissions

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Agenda

WHQL Overview

- Logo Requirements

- Test Assertions

Tips for Submission Success

Faster Submissions for Drivers

Whistler Logo Requirements

- IA-64 Requirements

Whistler Hardware Logo Kit

Calls to Action

WHQL Overview

What WHQL Does

- ✍ **Validate hardware and drivers to the Windows* Hardware Logo requirements**
- ✍ **Test hardware and drivers on Windows 9x, Windows NT 4.0 and Windows 2000**
- ✍ **Provide digitally signed drivers**
- ✍ **Produce HW Compatibility List (HCL)**
- ✍ **Provide customer support for test kits, Design Guides, OS related issues**

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Logo Requirement: Content and Roles

- ✍ Logo program content managed by Microsoft Evangelism (in collaboration with OS Development)
- ✍ Logo program requirements driven by
 - **Operating System**
 - **DDK, SDK**
 - **Hardware/Firmware platform requirements**
 - Industry Specs (ACPI, PCI, EFI, etc)
 - Server Design Guides
 - PCXX System Design Guides
- ✍ Logo program administered by WHQL

Path from Requirements to Tests

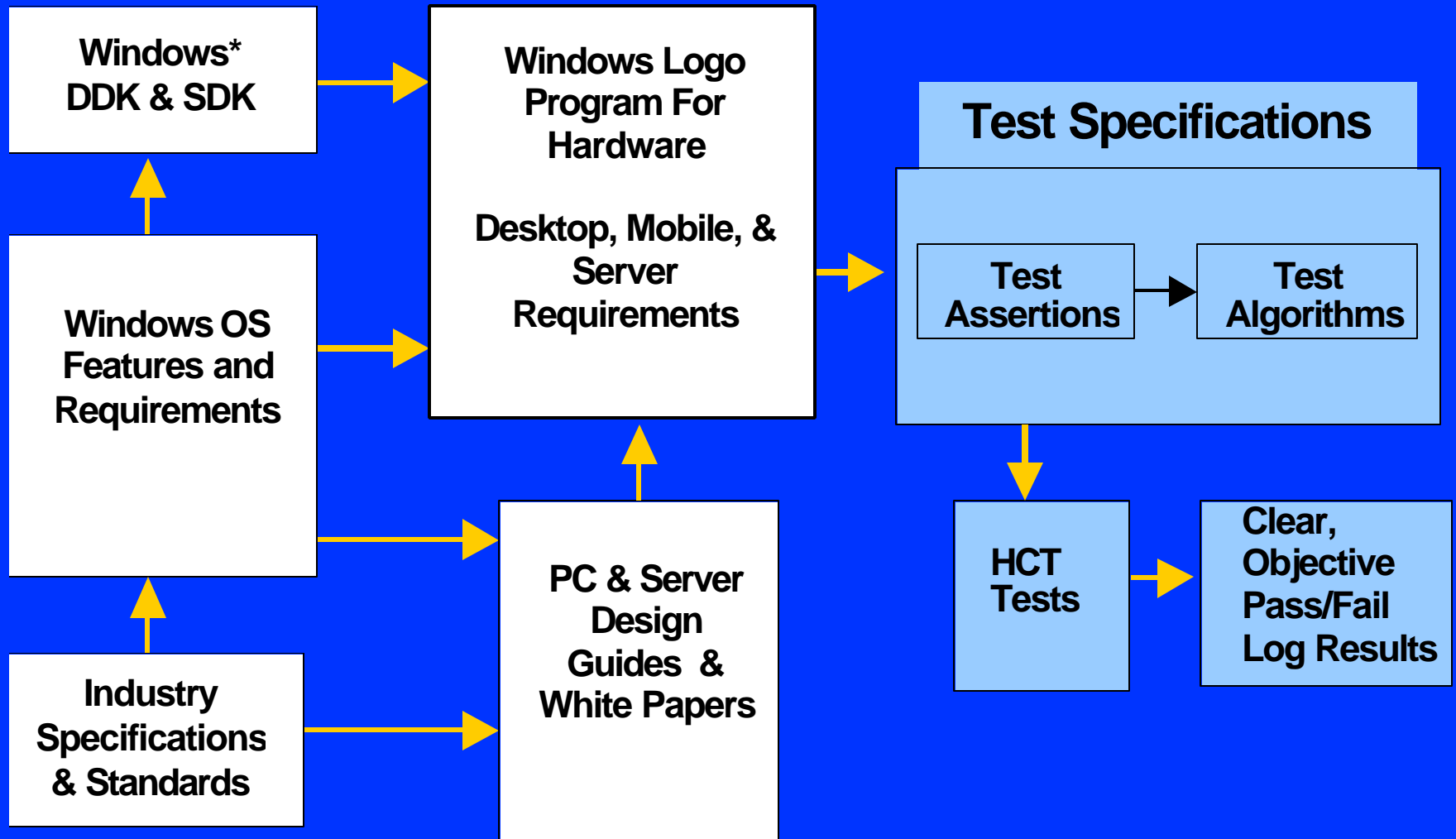
- ✍ Windows Logo Requirements provide guidelines for tests supporting the Windows Logo Program
- ✍ Test Specifications define a set of objective, non-arbitrary test assertions based on requirements
- ✍ Test algorithms are derived from the assertions
- ✍ Test tools then provide, clear, objective pass/fail results in log files mapped directly to assertions

Tests Map to Logo Requirements

Agenda

- ✍ WHQL Overview
 - Logo Requirements
 - **Test Assertions**
- ✍ Tips for Submission Success
- ✍ Faster Submissions for Drivers
- ✍ Whistler Logo Requirements
 - IA-64 Requirements
- ✍ Whistler Hardware Logo Kit
- ✍ Calls to Action

HCT Kit Flow



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What is a Test Assertion?

Definition:

A truth statement declaration of a single feature criterion in a Test Specification that extracts the precise Window Logo requirement(s) for validation on Whistler referencing Design Guides, DDKs or White Papers.

Usage:

- ✍ Declared in test specs with references to source documents
- ✍ Assertions include criteria that are testable & non-testable
- ✍ A set of assertions in a test specification forms an interpretation of the source documents

Clearly defines pass/fail criteria

Example of a Test Assertion

Example: H/W Spec X-ref to Windows* Logo Program Requirements

- ✍ Win Logo Req: A5.4.4: Comply with EFI 1.0 or later for detection of boot devices, plus *Hardware Design Guide* guidelines (**SDG3:150.2**)
- ✍ Test Assertion: 2.27.2: All Boot#### (1000, 1001, 1002, 1004) variables successfully saved by the test must be present in the NVRAM.
- ✍ Test Description: Verifies the functionality of the mandatory EFI NVRAM variable BootOrder by creating some arbitrary Boot#### options and resetting the platform to see that the applications are started, run in the required sequence and receive their load options correctly

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Example of Assertion based Log File Output

Boot Manager Variables Test

...

<<Assertion 2.27.2>>

All Boot#### (1000, 1001, 1002, 1004)
variables successfully saved by the test must
be present in the NVRAM.

<<Passed Assertion 2.27.2>>

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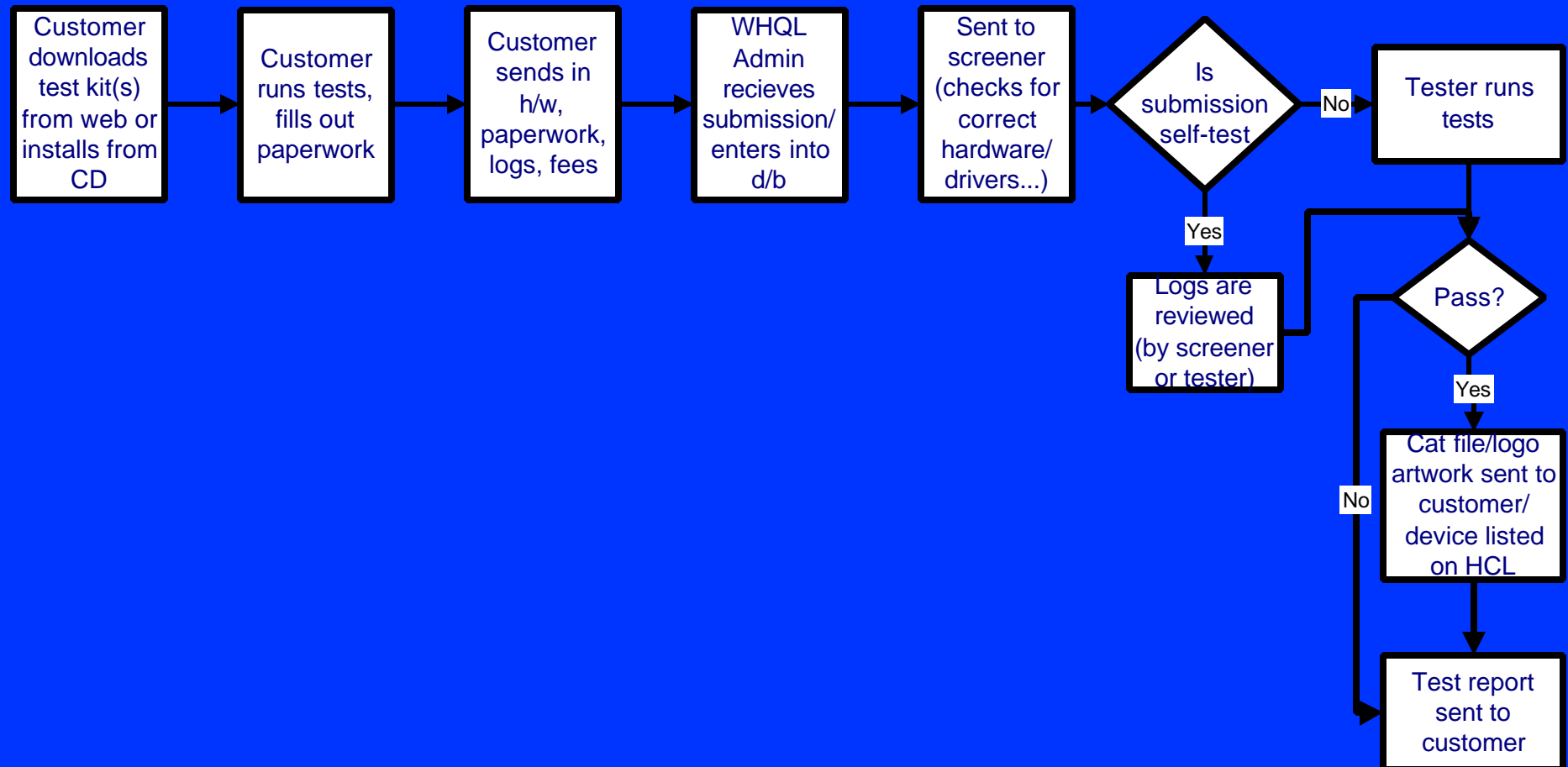
Whistler Logo Requirements

- IA-64 Requirements

Whistler Hardware Logo Kit

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Submission Process Step-by-Step



Tips for Submission Success

1. Document all test failures completely and accurately
 - Use Readme.txt file
 - Use Current MDR
2. Make sure that all required paperwork is present in the submission
3. Use the latest available test kit
 - <http://www.microsoft.com/hwtest/testkits>
4. Use all required OS's for testing
5. Verify that drivers used are listed on the HCL
 - <http://www.microsoft.com/hcl>

More Tips for Success

6. Make sure all required devices are present in the submission
7. Run all required tests for submission
<http://www.microsoft.com/hwdev/winlogo>
8. Use the same BIOS revision for each OS test.
9. Make sure System configuration meets the specified category requirements
10. Make sure that the system logs match the system submitted

System Configuration Tips

1. Make sure all devices in system are listed in the HCL
 - <http://www.microsoft.com/hcl>
2. Enterprise class Server must have RAID
3. Install Maximum RAM for a system when submitting

More Configuration Tips

4. Run all pre-OS tests
 - <http://www.microsoft.com/hwtest/testkits>
5. Use Foxfire II card during validation
6. Max processor speed submitted must match System denoted speed.

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Whistler Hardware Logo Kit

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Faster Submissions for Drivers

Quick-Sign Program



-  Provides qualified vendors digital signatures for first articles and driver updates via the internet
-  Drivers must meet current Logo requirements
-  First article submissions can now go through Quick-Sign
-  Initial goal for turnaround time is 48hrs

Quick-Sign Program: Eligibility

- ✍ Eligibility is based on passing rates for current submissions
 - **Must meet 90% on a per submission category basis over the previous 90 days**
- ✍ OEMs may submit on behalf of a vendor
 - **Any audit failures are applied to submitter**
- ✍ Quick-Sign is now available for Windows* Me, Windows 98 and Windows 2000
 - **Program will be implemented for Whistler**

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Quick-Sign Program

Requirements

- ✍ Single point of contact for company and a backup
 - Someone to contact if problems arise
- ✍ FTP server with a location dedicated to WHQL
 - Allows posting of signed drivers back to you
- ✍ A Class-3 code-signing digital id from VeriSign
 - Validates that the package submitted is from you and not someone else
- ✍ Quick-Sign agreement and a Driver Distribution agreement signed by a director level representative
 - <http://www.microsoft.com/hwtest/signatures>

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Windows* Logo V2.0: Whistler



Whistler Logo Requirements Document:

- ? Today: Whistler requirements can be found in the “Future” section of the Desktop and Mobile PC Requirements document, v.1.1 and the Server Design Guide 3.0
- ? 0.5 draft of version 2.0 - Incorporates Whistler requirements (IA-32 and IA-64), Server, future OS (release after Whistler)
- ? 0.7 draft - Target: Beta 1 of Whistler (Oct ‘00) , shipped with beta Test Specs
- ? 0.9 draft - Target: Between Beta 1 and closer to RC1
- ? Final 2.0 - Target: Whistler RC1 and includes the final Test Specs and HCT kit

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Windows* Logo Test Coverage



- ✍ **Storage: DVD & ATA advances**
- ✍ **Legacy Reduction (same as Windows 2000)**
- ✍ **Digital Media**
 - **Digital display interfaces: DVI (if implemented as feature)**
 - **DirectX* 8**
- ✍ **Bus & I/O advances (new tests based on current requirements):**
 - **USB 1.1 (new hub and system tests)**
 - **Legacy Free (if implemented as feature)**
 - **BlueTooth (if implemented as feature)**
 - **USB 2.0 (if implemented as feature)**
 - **PCI-X (if implemented as feature)**

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Windows* Logo Program

IA-64 Systems



- ✍ Very few changes from Windows 2000 test suite
- ✍ WHQL porting Windows 2000 HCT kit to IA-64 and adding tests for new requirements
- ✍ Windows Logo Program V2.0 will contain Server Design Guide v. 3.0 IA-64 requirements

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Whistler Test Coverage

IA-64 Systems



- ✍ ACPI 2.0 Table Extensions and ACPI Stress
- ✍ Extensible Firmware Initiative (EFI)
- ✍ Ported IA-64 native-mode tests for Server and Workstations
 - Driver Verifier
 - Signability Test (Inf Check)
 - 48 hr Stress
 - PCI
 - NDIS 3.86

Whistler Test Coverage (cont.)

IA-64 Systems

Storage tests for Server and Workstations

- CD Redbook Verification Test
- CD-ROM (File I/O)_D
- CD-ROM(Audio Cert)_D
- DVD Test
- Media Locking Test
- Media Status Notification
- SD Stress
- FAT(File I/O) (Storage)_D
- Int 13H Extensions

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WHQL Logo Kit

Whistler Schedule Overview



- ✍ WHQL working to synchronize Logo kit releases with operating system milestones
- ✍ Beta of Logo kit released with RC1 of Whistler
 - This is your chance to see future tests & requirements
 - Goal is no added tests/reqs after Beta release of kit
- ✍ Official Whistler Logo kit released at final release candidate before Whistler RTM

Digital Signatures

Whistler

- ✍ Drivers submitted (and passing) for Windows* 2000 & Whistler will receive a single cat file with both attributes.
- ✍ Whistler will recognize drivers signed under Windows 2000 as valid digital signatures
- ✍ Whistler only signed drivers will not work on Windows 2000

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Calls To Action

- ✍ Understand Submission Requirements
- ✍ Subscribe to the WHQL Weekly newsletter for program updates
 - <http://www.microsoft.com/hwtest/news/>
- ✍ Sign up for the Quick-Sign driver program
 - <http://www.microsoft.com/hwtest/signatures>

Informational URL's

- ✍ Complete set of Windows Logo requirements and proposed Whistler requirements can be found at:
 - <http://www.microsoft.com/hwdev/winlogo/>
- ✍ Follow WHQL web site for updates on Windows Whistler Logo Kit
 - <http://www.microsoft.com/hwtest>
- ✍ Visit the digital signature Web sites at:
 - <http://www.microsoft.com/hwtest/signatures>
 - <http://www.microsoft.com/hwdev/supportability>

Informational URL's (cont'd)



Requirement updates and clarifications:

Logo News:

<http://www.microsoft.com/hwdev/winlogo/news.htm>

WHQL News:

<http://www.microsoft.com/hwtest/news/>

Test Kits:

<http://www.microsoft.com/hwtest/testkits>

Apply for Quick-Sign

<http://www.microsoft.com/hwtest/signatures>

Some Industry documents

PCI and related Specifications:

- <http://www.pcisig.com>

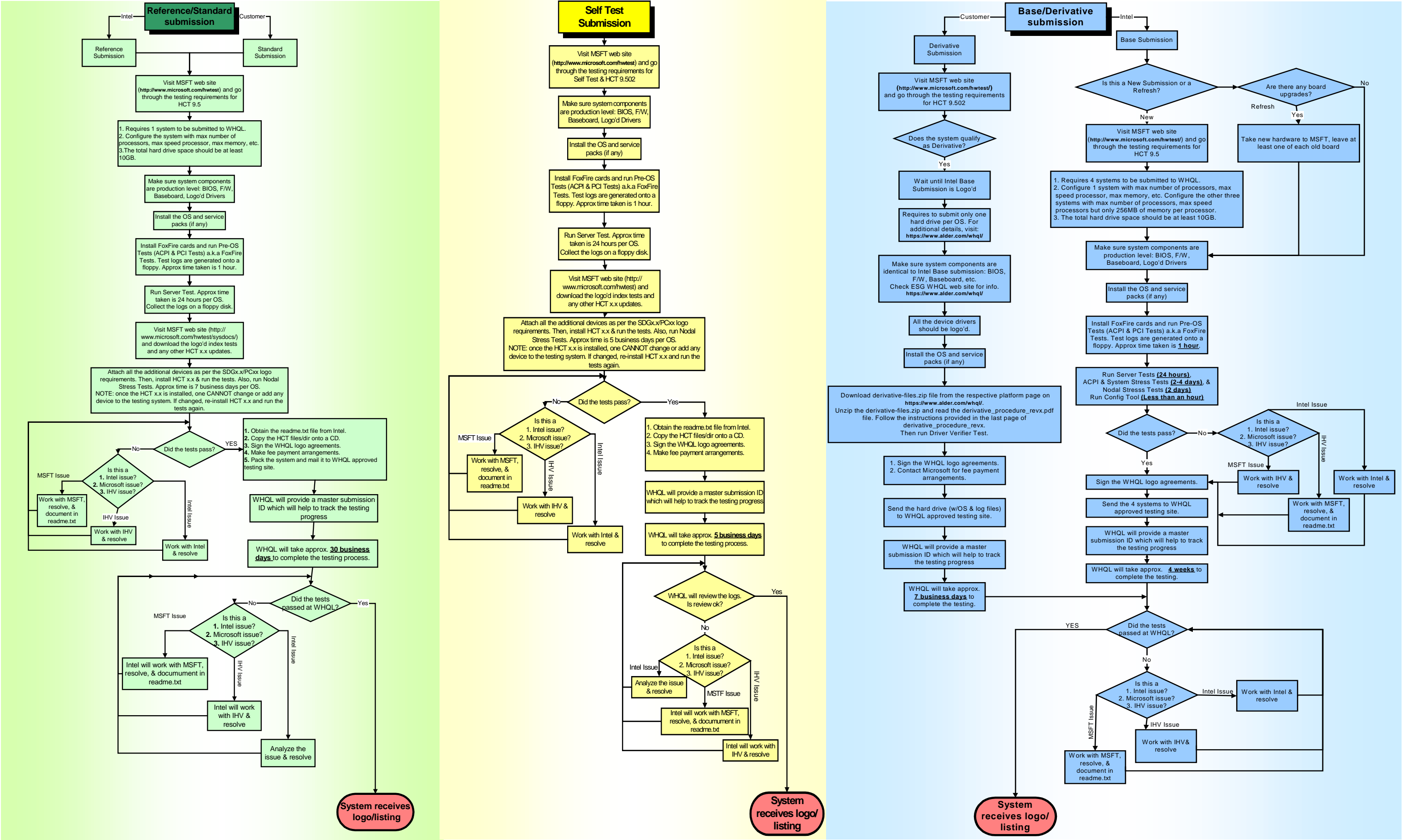
Current ACPI Specifications:

- <http://www.teleport.com/~acpi/>

Server Design Guide v3.0

- <http://www.microsoft.com/hwdev/serverdg.htm>
- <http://developer.intel.com/design/servers/desguide/hdgv3.htm>

Server Submission Types at WHQL and Testing Process



IA-64 HDG 3.0 Compliance Checklist

<u>Guideline</u>	<u>Summary</u>	<u>Req'd/Recom/Opt</u>
IA-64 Server Component Requirements		
IA-64 General Component Requirements		
1	System and components properly support all dates	Required
IA-64 System Microprocessor Requirements		
2	Multiprocessor-capable system meets Windows* requirements and minimum expansion requirements	Required
2.1	Enterprise class server system supports expansion to at least four processors	Required
2.3	IA-64 multiprocessor-capable system complies with ACPI 2.0	Required
IA-64 Memory Requirements		
4	For IA-64 system installed memory meets minimum requirements	Required
6	For IA-64 system, memory capacity meets minimum requirements	Required
7	System memory includes ECC memory protection	Required-<4P=16GB, >4P=32GB
8	NUMA and NUMA-“lite” system designs maintain near:far memory access time ratios of 1:3 or less	Recommended
IA-64 ACPI and Power Management Requirements		
9	System design meets ACPI 2.0 and related requirements	Required
9.1	Server system implements basic ACPI and power management capabilities	Required
9.2	SOHO server implements additional ACPI and power management capabilities	Required
10	Hardware design supports OnNow initiative	Required
10.1	Buses on system that supports S1–S3 meet bus power management requirements	Required
10.2	All devices and drivers support D0 and D3 power states	Required
10.3	System provides software-controlled, ACPI-based power switch	Required
10.4	System that support S1–S3 provides one or more indicators to show whether the system is in the working or sleep state	Required
10.5	For SOHO server and any other server that supports S3, the system power supply provides “standby” power for wake-up events	Required
11	System startup meets requirements for OnNow support	Required for SOHO, Optional for all others
IA-64 Startup Support Requirements		
12	System firmware meets general boot support requirements	Required
12.1	System firmware supports SMBIOS 2.3	Required
12.2	Firmware implements security, such as a preboot password	Required
12.3	Firmware supports BIS	Required

IA-64 HDG 3.0 Compliance Checklist

12.4	Firmware provides boot support for CD and DVD drives	Required
12.5	System supports firmware update mechanism	Required
14	IA-64 system complies with EFI 1.0 or later, with support for USB boot devices, firmware update and PXE_BC, SERIAL_IO, and SIMPLE_NETWORK protocols	Required
14.1	EFI IA-64 system supports network-based boot via EFI boot manager	Required
14.2	EFI IA-64 system provides boot support for USB keyboard and bus	Required
14.3	EFI IA-64 system implements SAL, including firmware update method	Required
14.4	EFI IA-64 system firmware supports console redirection to a serial port	Required
14.5	EFI IA-64 system firmware provides boot support for CD and DVD drives	Required
14.6	EFI IA-64 system provides minimum required boot list variable storage	Required
14.7	EFI IA-64 system provides a minimum, firmware-based driver set sufficient to allow boot, installation, and recovery operations without the presence of loadable media-based EFI drivers	Required
15	System provides a debug port solution	Required
15.2	IA-64 system meets debug port and configuration requirements	Required
IA-64 Plug and Play Requirements		
16	System and device configuration meet Plug and Play requirements	Required
17	Unique Plug and Play ID is provided for each system device and add-on device	Required
18	"PNP" vendor code is used only to define a legacy device's Compatible ID	Required
IA-64 Other Requirements		
25	IA-64 system includes SAPIC support	Required
25.1	IA-64 core chipset interrupt delivery mechanisms use SAPIC-compatible programming model	Required
25.2	IA-64 system uses SAPIC-compatible programming model	Required
26	IA-64 system supports message-signaled interrupts	Recommended
27	System with no 8042 or other port 60h and port 64h based keyboard controller meets Hardware Design Guide requirements	Required
IA-64 System Bus and Device Requirements		
IA-64 I/O Bus Requirements		
29	System provides an I/O bus based on industry standard specification	Required
30	All PCI adapters function properly on system supporting more than 4 GB memory	Required
31	All PCI bridges in a IA-64 system support DAC	Required
32	System supports a 64-bit PCI bus architecture	Required
33	PCI bus and devices comply with PCI 2.2 and other requirements	Required
34	PCI devices in an IA-64 system support message-signaled interrupts	Recommended
35	System makes best effort to provide each PCI slot and device type access to a non-shared interrupt line	Required
36	System does not contain ghost devices	Required
37	PCI-to-PCI bridges comply with PCI-to-PCI Bridge Spec. 1.1	Required

IA-64 HDG 3.0 Compliance Checklist

38	System uses standard method to close BAR windows on nonsubtractive decode PCI bridges	Required
39	PCI devices do not use the <1 MB BAR type	Required
40	PCI devices decode only their own cycles	Required
41	VGA-compatible devices do not use non-video I/O ports	Required
42	PCI chipsets support Ultra DMA (ATA/33, minimum)	Required
43	Functions in a multifunction PCI device do not share writable PCI configuration space bits	Required
44	Devices use the PCI configuration space for their Plug and Play IDs	Required
45	Device IDs include PCI Subsystem IDs	Required
46	Interrupt routing is supported using ACPI	Required
47	System that supports hot swapping or hot plugging for any PCI device uses ACPI-based methods	Required
48	All 66-MHz and 64-bit PCI buses in a server system comply with PCI 2.2 and other requirements	Required
49	All PCI devices complete memory write transaction (as a target) within specified times	Required
50	All PCI components comply with PCI Bus Power Management Interface specification	Required* (if S1,S2 or S3 is supported - or for all SOHO servers)
51	System that supports S3 or S4 state provides support for 3.3Vaux	Required* (for SOHO, others recommended only)
52	PCI bus power states are correctly implemented	Required* (if S1,S2 or S3 is supported - or for all SOHO servers)
53	Software PCI configuration space accesses on an IA-64 system use SAL procedures	Required
54	PCI-X buses and devices, if present, meet requirements for device and driver	Required
55	InfiniBand fabric connections, fabrics, and devices, if present, meet requirements for device and driver support	Required
IA-64 USB Requirements		
56	System includes USB controller with at least one USB port	Required
57	All USB hardware complies with USB 1.1	Required
58	USB devices and drivers support maximum flexibility of hardware interface options	Required
59	System and devices comply with USB power management requirements	Required
60	USB devices comply with their related USB device class specifications	Required
61	USB hubs are self-powered	Required
62	USB devices install without pre-loading software	Required
IA-64 Other Bus Requirements		
63	Any subsystems implementing I2O comply with standards and other requirements	Required
64	System does not include ISA or LPC expansion slots	Required

IA-64 HDG 3.0 Compliance Checklist

65	System does not include embedded ISA or LPC network adapters, storage controllers, or graphics adapters	Required
66	System does not include ISA or LPC expansion devices	Required
67	System that supports Winsock Direct connectivity meets requirements for device and driver support	Required
IA-64 Device Requirements		
68	Device driver and installation meet Hardware Design Guide requirements	Required
68.1	All devices and drivers meet requirements defined in the guide	Required
68.2	All configuration settings are stored in the registry	Required
68.3	Files have correct identifiers and are stored in the correct locations	Required
68.4	Driver installation and removal use methods defined in the Windows 2000 DDK	Required
68.5	Driver supports unattended installation	Required
68.6	Windows Help file is provided if special driver parameters are used	Required
69	Keyboard and mouse connections meet requirements for bus and device classes	Required
70	Serial port adapter meets device class specifications for its bus	Required
71	IA-64 system does not include parallel port	Required
73	USB-to-printer port adapters comply with USB specifications	Required
74	System includes emergency repair support	Required
75	Primary graphics adapter on IA-64 system meets minimum requirements	Required
IA-64 System Networking and Communications Requirements		
IA-64 Network Adapter Requirements		
77	System includes non-ISA/non-LPC NDIS 5.0 network adapter	Required
78	Network adapter uses NDIS 5.0 miniport driver	Required
78.1	The network adapter driver must be based on and comply with NDIS 5.0 in order to take advantage of Windows 2000 operating system capabilities.	Required
78.2	If the network device is for connection-oriented media, it must meet connection-oriented miniport driver and call manager driver requirements.	Required
78.3	An intermediate NDIS 5.0 miniport driver is required for network adapters that connect to the system using IEEE 1394 or USB buses.	Required
78.4	Driver works correctly with Microsoft network clients and protocols	Required
78.5	Driver makes only NDIS library calls or WDM system calls	Required
78.6	Driver uses Windows 2000 INF format	Required
78.7	Driver is deserialized	Required
79	NDIS 5.0 miniport driver supports high-performance send and receive calls	Required
80	Full-duplex adapter automatically detects and switches to full-duplex mode	Required
81	Network adapter automatically senses presence of functional network connection	Required
82	Network adapter automatically senses transceiver type	Required

IA-64 HDG 3.0 Compliance Checklist

83	Network adapter can transmit packets from buffers aligned on any boundary	Required
84	Network adapter communicates with driver across any bridge	Required
85	Network adapter supports configuration capabilities and registry settings for performance tuning	Required
86	PCI network adapter properly supports higher-level PCI commands	Required
87	PCI network adapters are bus masters	Required
88	USB or IEEE 1394 network device complies with related device class specifications	Required
89	Network device and driver meet Plug and Play and power management requirements	Required
90	Network communications device supports wake-up events	Recommended
IA-64 Connectionless Networking Requirements		
91	Network adapter offloads TCP/IP checksum, IP Security encryption, and TCP message segmentation	Recommended
92	Network adapter supports filtering for at least 32 multicast addresses	Required
93	Server network adapter supports Load Balancing and Failover capabilities	Recommended
94	Server network adapter supports remote system setup capabilities	Recommended
95	Network connections used for remote boot meet PXE requirements	Required
96	Network adapter and driver support promiscuous mode	Required
97	Network adapter and driver support multicast promiscuous mode	Required
98	Network adapter and driver support priority for IEEE 802-style networks	Required
IA-64 Modem Requirements		
99	System includes WAN communications device	Recommended
IA-64 Unimodem-supported Modem Requirements		
100	Modem controller meets minimum requirements	Required
101	PSTN modem supports ITU-T V.250 command set	Required
102	Device complies with device class power management	Required
103	Device supports wake-up events	Required
104	Data modem supports v.90 and v.34 modulation and other requirements	Required
105	Data modem supports digital connection to support host-side V.90 operation	Required for AS, DC or Enterprise, Recommended for all others
106	Fax modem supports 14.4 Kbps (V.17) with Class 1 (T.31) command set	Required for PSTN connected modems, recommended for ISDN
107	Modem supports call control signaling, controlled using V.251 modem commands	Required
108	Modem supports blacklisted and delayed number clearing	Required (were applicable)

IA-64 HDG 3.0 Compliance Checklist

109	Voice modem support is provided	Optional, Recommended for SOHO
110	Voice modem supports ITU V.253 (AT+V)	Required for PSTN, recommended for ISDN or T1
IA-64 ATM Adapter Requirements		
111	ATM adapter meets network adapter requirements	Required
112	ATM adapter supports a minimum number of simultaneous connections	Required
113	ATM adapter supports all service types defined by the ATM Forum	Required for AS, DC, Recommended for all others
114	ATM adapter supports UBR service type	Required
115	ATM adapter supports a minimum number of simultaneously active VBR or CBR connections	Required
116	ATM adapter supports traffic shaping	Required
117	ATM adapter enforces PCR on UBR virtual circuits	Required
118	ATM adapter and driver support dynamic link speed configuration	Required
119	ATM adapter supports OAM	Required
120	ATM adapter supports buffer chaining (Tx + Rx)	Required
IA-64 ADSL Requirements		
121	ADSL device is implemented as an integrated ADSL modem	Recommended
122	Integrated ADSL modem meets network adapter requirements	Required
123	ATM/ADSL solution is implemented for integrated ADSL modems	Recommended
124	ADSL modem supports DMT line encoding	Recommended
125	ADSL modem supports rate adaptation	Recommended
IA-64 Cable Modem Requirements		
126	Device is implemented as an integrated cable modem	Recommended
127	Integrated cable modem meets network adapter requirements	Required
128	Integrated cable modem exposes an ATM or Ethernet interface	Required
IA-64 Serial ISDN Modem Requirements		
129	ISDN modem supports required command set	Required
130	ISDN modem exposes both B channels	Recommended
131	ISDN modem supports asynchronous-to-synchronous conversion	Required
132	ISDN modem uses high-speed port	Recommended
133	ISDN modem driver supports unattended installation, with limitations	Required
IA-64 Parallel ISDN Modem Requirements		
134	Internal ISDN device meets network adapter requirements	Required

IA-64 HDG 3.0 Compliance Checklist

135	Internal ISDN device supports synchronous HDLC framing	Required
136	Internal ISDN device and driver support raw unframed synchronous B channel I/O	Required
137	Driver for ISDN internal device supports unattended installation, with limitations	Required
138	ISDN device with U-interface includes built-in NT- 1 capability	Recommended
139	Internal ISDN device has software-selectable terminating resistors	Required
IA-64 IRDA Device Requirements		
140	Infrared network adapter meets network adapter requirements	Required
141	Infrared device supports both FIR and SIR	Required
142	IrDA hardware reports a unique Plug and Play ID sufficient to support unattended driver installation	Required
IA-64 Wireless Networking Device Requirements		
143	Wireless networking media adapters meets network adapter requirements	Required
144	Wireless networking media adapters support wireless extensions to NDIS	Required
145	Wireless networking adapters support industry specifications	Required
IA-64 System Storage Device Requirements		
IA-64 Storage Device General Requirements		
146	Host controllers and devices support bus mastering	Required
148	Block rewritable optical ATAPI device complies with SFF 8070i	Required
149	Controller and peripherals support media status notification	Required
150	Operating system recognizes the boot drive in a multiple-drive system	Required
150.2	EFI IA-64 system complies with EFI 1.0 or later for detection of boot devices, plus Hardware Design Guide requirements	Required
151	IA-64 system provides GPT-partitioned hard drive for boot	Required
152	IA-64 system with GPT-partitioned bootable hard disks provide one ESP of correct size	Required
153	IA-64 system with ESP contains only components needed for system boot, installation or recovery	Required
154	EFI IA-64 system provides restoration tool for recovery of critical ESP and OEM and special partition contents	Required
155	For EFI IA-64 system, MSR partition of correct size is present on every physical or virtual disk manifested to the operating system when such disks are otherwise being partitioned by the provider of the system	Required
156	For IA-64 system, non-ESP partitions do not contain software required for boot	Required
157	For IA-64 system, ESP resides only on a device that can be reached through firmware-resident EFI drivers	Required
158	USB-based mass storage device complies with USB specifications	Required
159	IEEE 1394-based mass storage complies with 1394 OpenHCI 1.1	Required
160	Drivers for devices that use SBP-2 command protocols follow Windows 2000 guidelines	Required

IA-64 HDG 3.0 Compliance Checklist

	IA-64 SCSI Controllers and Peripherals	
161	System includes SCSI host controller and SCSI peripherals	Required for Servers running AS/DC
162	SCSI controllers with external connectors that can function as cluster nodes provide multi-initiator support	Required
163	Bus type is clearly indicated on connectors for all adapters, peripherals, cables, and terminators	Required
164	Differential devices support DIFFSENS as defined in SPI-3 standard	Required
165	Automatic termination circuit and SCSI terminators meet SCSI-3 specification	Required
166	Terminator power is supplied to the SCSI bus, with over-current protection	Required
167	External connector meets SCSI-2 or later specification	Required
168	Controller and peripherals implement SCSI data protection signal	Required
169	SCSI connections use keyed and shrouded connectors	Required
170	External devices provide SCSI 3 compliant termination	Required
171	SCAM support is not present	Required
172	Hardware supports the STOP/START UNIT command as defined in the SCSI Block Commands specification	Required
173	STOP/START UNIT command can be used to decrease power consumption	Recommended
174	SCSI devices that support hot-plugging comply with Annex D of SPI-3	Required
	IA-64 ATA Controllers and Peripherals	
175	System does not include ATA host controller and peripherals	Required for Servers running AS/DC
176	Dual ATA adapters use single FIFO with asynchronous access or dual FIFOs and channels	Required
177	ATA controller and peripherals comply with ATA/ATAPI-5 standards and support Ultra-DMA (ATA/33, minimum)	Required
178	ATA controller and peripheral connections include Pin 1 cable designation with keyed and shrouded connectors	Required
179	ATAPI peripherals comply with ATA/ATAPI-5	Required
180	ATAPI devices support DEVICE RESET command	Required
181	ATA/ATAPI device supports ATA STANDBY command	Required
	IA-64 Fibre Channel Controllers and Peripherals	
182	System includes Fibre Channel controller and peripherals	Recommended/ Optional for SOHO
	IA-64 Erasable Disk Drives	
183	SCSI erasable drives support SCSI commands	Required
	IA-64 CD and DVD Drives	
184	System includes CD or DVD drive or other method for installing the operating system	Required
	IA-64 CD Drive Requirements	

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185	CD drive provides 8x or higher performance	Required
186	CD drive is CD-Enhanced compatible	Required
187	CD drive supports specified logical and physical CD formats	Required
188	ATA/ATAPI CD drive complies with MMC-2	Required
189	CD drive supports multisession and compatibility forms of the READ_TOC command	Required
190	ATA/ATAPI CD changer meets MMC-2 standard	Required
IA-64 DVD Drive Requirements		
191	DVD device provides 2 MB minimum transfer rate or better performance anywhere on the disk	Required
192	DVD drive meets minimum compatibility requirements	Required
193	DVD drive supports defect management	Required
194	DVD-Video playback, if present, meets DVD-Video playback requirements	Required
IA-64 Backup Devices		
195	System includes device for local backup	Recommended
196	Single-backup device meets minimum capacity requirements	20GB for Enterprise class-10GB all others
197	Backup device meets industry standards	Required
198	Driver integrated with Removable Storage Manager	Required
IA-64 CD Changers		
199	CD changer for seven or fewer discs meets MMC-2 standard	Recommended
IA-64 Tape and Optical Disk Changers		
200	SCSI changer and drive support auto-configuration	Required
201	SCSI tape and optical disk changers support SCSI commands	Required
IA-64 System Physical Design and Hardware Security Requirements		
IA-64 Physical Design Requirements		
202	Icons are provided for all external connectors	Required
203	All expansion slots in the system are accessible for users to insert cards	Required
204	System and device design include protected switches	Recommended
205	System design includes locking case	Recommended
206	System and device design include positive retention connectors	Recommended
IA-64 Hardware Security Requirements		
208	C2 evaluation for hardware	Recommended
209	Peripherals follow hardware security recommendations	Recommended
IA-64 System Reliability, Availability, and Serviceability Requirements		
IA-64 Backup Hardware		
210	System includes integrated backup solution	Recommended
IA-64 Power Supply		
211	System includes UPS provided with system	Recommended

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212	System includes power supply protection using N+1 (extra unit)	Required for Enterprise servers running AS/DC- Recommended for all others
213	System supports replacement of power supplies	Required
214	System supports replacement of fans	Required
215	System includes local hot-swap power supply replacement indicators	Required for systems running AS/DC- Recommended for all others
IA-64 Fault-Tolerant Hardware		
216	System incorporates multiple hard drives	Required for systems running AS/DC- Recommended for all others
217	System includes intelligent RAID controller with adequate storage capacity	Required for all Enterprise class systems and systems running MSCS clustering
218	System supports at least one of RAID 1, 5, or 1/0	Required for all Enterprise class systems and systems running MSCS clustering
219	RAID support includes notification of failed drive	Required
220	RAID subsystem supports automatic replacement of failed drive	Required for all Enterprise class systems and systems running MSCS clustering
221	RAID subsystem supports manual replacement of failed drive	Required for all Enterprise class systems and systems running MSCS clustering

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	IA-64 High Availability Requirements	
223	System includes alert indicators for occurrence of failure	Required for systems running AS/DC- Recommended for all others
224	Hot-swappable drive includes a local disk drive replacement indicator	Required
225	System includes alert indicators for imminence of failure	Required for systems running AS/DC- Recommended for all others
226	System supports monitoring for power and down conditions	Required
	IA-64 General Manageability Baseline Requirements	
227	Remote new system setup and service boot support uses DHCP and TFTP	Recommended
228	Expansion devices can be remotely managed	Recommended
	IA-64 Manageability Component Instrumentation Requirements	
229	System supports Windows Hardware Instrumentation Implementation Guidelines	Required
230	IA-64 hardware and firmware support IA-64 Machine Check Architecture	Required
230.1	IA-64 system uses Machine Check Architecture for error reporting and logging	Required
230.2	IA-64 firmware implements support for Machine Check Architecture	Required
230.3	IA-64 Machine Check Architecture supports code resources	Required
231	Platform supports event logging for critical events	Required

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Guideline	Summary	Req'd/Recom/Opt
IA-32 System Component Requirements		
IA-32 General Component Requirements		
1	System and components properly support all dates	Required
2	Multiprocessor-capable system meets Windows* requirements and minimum expansion requirements	Required
2.1	All Enterprise class server systems support expansion to at least four processors	Required
2.2	IA-32 multiprocessor-capable system supports MPS 1.4 and ACPI 1.0b	Required
IA-32 Memory Requirements		
3	For IA-32 system, installed memory meets minimum requirements	Required
5	For IA-32 system, memory capacity meets minimum requirements	Required
7	System memory includes ECC memory protection	Required
8	NUMA and NUMA-“lite” system designs maintain near:far memory access time ratios of 1:3 or less	Recommended
IA-32 ACPI and Power Management Requirements		
9	System design meets ACPI 1.0b and related requirements	Required
9.1	Server system implements basic ACPI and power management capabilities	Required
9.2	SOHO server implements additional ACPI and power management capabilities	Required
10	Hardware design supports OnNow initiative	Required
10.1	Buses on system that supports S1-S3 meet bus power management requirements	Required
10.2	All devices and drivers must support the D0 and D3 power states	Required
10.3	System provides software-controlled, ACPI-based power switch	Required
10.4	System that support S1-S3 provides one or more indicators to show whether the system is in the working or sleep state	Required
10.5	For all SOHO servers and any other servers that support S3, the system power supply provides “standby” power for wake-up events	Required
11	System startup meets OnNow requirements	Optional/Required for SOHO
IA-32 Startup Support Requirements		
12	System firmware meets general boot support requirements	Required
12.1	System firmware supports SMBIOS 2.3	Required
12.2	Firmware implements security, such as a preboot password	Required
12.3	Firmware supports BIS	Required
12.4	Firmware provides boot support for CD and DVD drives	Required
12.5	System supports firmware update mechanism	Required
13	IA-32 BIOS boot system supports remote/network boot, USB boot devices, and firmware update	Required
13.1	IA-32 BIOS boot system supports PXE 2.1	Required

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13.2	IA-32 BIOS boot system supports CIP BIOS Boot 1.01 for network-based boot	Required
13.3	IA-32 BIOS boot system supports USB keyboard, mice, and hubs as boot devices	Required
13.4	IA-32 BIOS boot system firmware supports console redirection to a serial port, if serial headless server support is implemented in the system	Required
15	System provides a debug port solution	Required
15.1	IA-32 system meets debug port and configuration requirements	Required
IA-32 Plug and Play Requirements		
16	System and device configuration meet Plug and Play requirements	Required
17	Unique Plug and Play ID is provided for each system device and add-on device	Required
18	"PNP" vendor code is used only to define a legacy device's Compatible ID	Required
"Headless Server" Requirements		
19	IA-32 system provides headless server capabilities meeting Hardware Design Guide requirements	Required for Enterprise, Recommended all others
20	IA-32 system that implements headless capabilities without management service processor provides serial headless support	Required
20.1	IA-32 system without management service processor supports BIOS redirection of console output to the headless serial port	Required
20.2	IA-32 system without management service processor provides properly configured legacy serial port	Required
20.3	IA-32 system headless connections are null modem cables that support Carrier Detect signal	Required
21	IA-32 system that implements management service processor and external serial headless capability supports required external serial port and remote system reset	Required
21.1	IA-32 system with management service processor and external serial headless capability supports BIOS redirection of console output, plus serial port and serial headless cabling requirements	Required
21.2	IA-32 system with management service processor and external serial headless capability supports sharing of the service processor serial port with Windows	Required
21.3	IA-32 system with management service processor and external serial headless capability supports remote system reset capabilities	Required
22	IA-32 system with management service processor but no external serial connection meets reset and display redirection requirements	Required
23	Uninterruptible power supply with pass-through legacy serial port supports sharing of pass-through serial port with Windows headless capabilities	Required
IA-32 Other Requirements		
24	IA-32 system includes APIC support	Required
27	System with no 8042 or other port 60h and port 64h based keyboard controller meets Hardware Design Guide requirements	Required

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28	IA-32 system provides necessary ISR support	Required
IA-32 System Bus and Device Requirements		
IA-32 I/O Bus Requirements		
29	System provides an I/O bus based on industry standard specification	Required
30	All PCI adapters function properly on system supporting more than 4 GB memory	Required
32	System supports a 64-bit bus architecture	Required*
33	PCI bus and devices comply with PCI 2.2 and other requirements	Required
35	System makes a best effort to provide each PCI slot and device type access to a non-shared interrupt line	Required
36	System does not contain ghost devices	Required
37	PCI-to-PCI bridges comply with PCI to PCI Bridge Specification 1.1	Required
38	System uses standard method to close BAR windows on nonsubtractive decode PCI bridges	Required
39	PCI devices do not use the <1 MB BAR type	Required
40	PCI devices decode only their own cycles	Required
41	VGA-compatible devices do not use non-video I/O ports	Required
42	PCI chip sets support Ultra DMA (ATA/33, minimum)	Required for all except N/A for AS,DC
43	Functions in a multifunction PCI device do not share writable PCI Configuration Space bits	Required
44	Devices use the PCI Configuration Space for their Plug and Play IDs	Required
45	Device IDs include PCI Subsystem IDs	Required
46	Interrupt routing is supported using ACPI	Required
47	Systems that support hot swapping for any PCI device use ACPI-based methods	Required
48	All 66-MHz and 64-bit PCI buses in a server system comply with PCI 2.2 and other requirements	Required
49	All PCI devices complete memory write transaction (as a target) within specified times	Required
50	All PCI components comply with PCI Bus Power Management Interface specification	Required if S1,S2 or S3 is supported
51	System that supports S3 or S4 state provides support for 3.3Vaux	Recommended/ Required for SOHO
52	PCI bus power states are correctly implemented	Required if S1,S2 or S3 is supported
54	PCI-X buses and devices, if present, meet requirements for device and driver support	Required
IA-32 USB Requirements		
56	System includes USB controller with at least one USB port	Required
57	All USB hardware complies with USB 1.1	Required
58	USB devices and drivers support maximum flexibility of hardware interface options	Required
59	System and devices comply with USB power management requirements	Required

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60	USB devices comply with their related USB device class specifications	Required
61	USB hubs are self-powered	Required
62	USB devices install without pre-loading software	Required
IA-32 Other Bus Requirements		
63	Any subsystems implementing I ₂ O comply with standards and other requirements	Required
64	System does not include ISA or LPC expansion slots	Required
65	System does not include embedded ISA or LPC network adapters, storage controllers, or graphics adapters	Required
66	System does not include ISA or LPC expansion devices	Required
67	System that supports WinSock Direct Path connectivity meets requirements for device and driver support	Required
IA-32 Device Requirements		
68	Device driver and installation meet Hardware Design Guide requirements	Required
68.1	All devices and drivers meet requirements defined in the guide	Required
68.2	All configuration settings are stored in the registry	Required
68.3	Files have correct identifiers and are stored in the correct locations	Required
68.4	Driver installation and removal use methods defined in the Windows 2000 DDK	Required
68.5	Driver supports unattended installation	Required
68.6	Windows Help file is provided if special driver parameters are used	Required
69	Keyboard and mouse connections meet requirements for bus and device classes	Required
70	Serial port meets requirements for its bus	Required
72	If present on IA-32 system, legacy parallel port meets requirements for bus and device classes	Required
73	USB-to-printer port adapters comply with USB specifications	Required
74	System includes emergency repair support	Required
76	Primary graphics adapter on IA-32 system, if present, meets minimum requirements	Required
IA-32 System Networking and Communications Requirements		
IA-32 Network Adapter Requirements		
77	System includes non-ISA/non-LPC NDIS 5.0 network adapter	Required
78	Network adapter uses NDIS 5.0 miniport driver	Required
78.1	The network adapter driver must be based on and comply with NDIS 5.0 in order to take advantage of Windows 2000 operating system capabilities	Required
78.2	If the network device is for connection-oriented media, it must meet connection-oriented miniport driver and call manager driver requirements	Required
78.3	An intermediate NDIS 5.0 miniport driver is required for network adapters that connect to the system using IEEE 1394 or USB buses	Required
78.4	Driver works correctly with Microsoft network clients and protocols	Required
78.5	Driver makes only NDIS library calls or WDM system calls	Required

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78.6	Driver uses Windows 2000 INF format	Required
78.7	Driver is deserialized	Required
79	NDIS 5.0 miniport driver supports high-performance send and receive calls	Required
80	Full-duplex adapter automatically detects and switches to full-duplex mode	Required
81	Network adapter automatically senses presence of functional network connection	Required
82	Network adapter automatically senses transceiver type	Required
83	Network adapter can transmit packets from buffers aligned on any boundary	Required
84	Network adapter communicates with driver across any bridge	Required
85	Network adapter supports configuration capabilities and registry settings for performance tuning	Required
86	PCI network adapter properly supports higher-level PCI commands	Required
87	PCI network adapters are bus masters	Required
88	USB or IEEE 1394 network device complies with related device class specifications	Required
89	Network device and driver meet Plug and Play and power management requirements.	Required
90	Network communications device supports wake-up events	Recommended
IA-32 Connectionless Networking Requirements		
91	Network adapter offloads TCP/IP checksum, IP Security encryption, and TCP message segmentation	Recommended
92	Network adapter supports filtering for at least 32 multicast addresses	Required
93	Server network adapter supports Load Balancing and Failover capabilities	Recommended
94	Server network adapter supports remote system setup capabilities	Recommended
95	Network connections used for remote boot meet PXE requirements	Required
96	Network adapter and driver support promiscuous mode	Required
97	Network adapter and driver support multicast promiscuous mode	Required
98	Network adapter and driver support priority for IEEE 802-style networks	Required
IA-32 Modem Requirements		
99	System includes WAN communications device	Recommended
IA-32 Unimodem-supported Modem Requirements		
100	Modem controller meets minimum requirements	Required
101	PSTN modem supports ITU-T V.250 command set	Required
102	Device complies with device class power management	Required
103	Device supports wake-up events	Required
104	Data modem supports v.90 and v.34 modulation and other requirements	Required

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105	Data modem supports digital connection to support host-side V.90 operation	Required for Enterprise class and systems running AS/DC- Recommended for all others
106	Fax modem supports 14.4 Kbps (V.17) with Class 1 (T.31) command set	Required
107	Modem supports call control signaling, controlled using V.251 modem commands	Required
108	Modem supports blacklisted and delayed number clearing	Required
109	Voice modem support is provided	Optional, Recommended for SOHO
110	Voice modem supports ITU V.253 (AT+V)	Required
IA-32 ATM Adapter Requirements		
111	ATM adapter meets network adapter requirements	Required
112	ATM adapter supports a minimum number of simultaneous connections	Required
113	ATM adapter supports all service types defined by the ATM Forum	Required for AS, DC, Recommended for all others
114	ATM adapter supports UBR service type	Required
115	ATM adapter supports a minimum number of simultaneously active VBR or CBR connections	Required
116	ATM adapter supports traffic shaping	Required
117	ATM adapter enforces PCR on UBR virtual circuits	Required
118	ATM adapter and driver support dynamic link speed configuration	Required
119	ATM adapter supports OAM	Required
120	ATM adapter supports buffer chaining (Tx + Rx)	Required
IA-32 ADSL Requirements		
121	ADSL device is implemented as an integrated ADSL modem	Recommended
122	Integrated ADSL modem meets network adapter requirements	Required
123	ATM/ADSL solution is implemented for integrated ADSL modems	Recommended
124	ADSL modem supports DMT line encoding	Recommended
125	ADSL modem supports rate adaptation	Recommended
IA-32 Cable Modem Requirements		
126	Device is implemented as an integrated cable modem	Recommended
127	Integrated cable modem meets network adapter requirements	Required
128	Integrated cable modem exposes an ATM or Ethernet interface	Required
IA-32 Serial ISDN Modem Requirements		

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129	ISDN modem supports required command set	Required
130	ISDN modem exposes both B channels	Recommended
131	ISDN modem supports asynchronous-to-synchronous conversion	Required
132	ISDN modem uses high-speed port	Recommended
133	ISDN modem driver supports unattended installation, with limitations	Required
IA-32 Parallel ISDN Modem Requirements		
134	Internal ISDN device meets network adapter requirements	Required
135	Internal ISDN device supports synchronous HDLC framing	Required
136	Internal ISDN device and driver support raw unframed synchronous B channel I/O	Required
137	Driver for ISDN internal device supports unattended installation, with limitations	Required
138	ISDN device with U-interface includes built-in NT-1 capability	Recommended
139	Internal ISDN device has software-selectable terminating resistors	Required
IA-32 IRDA Device Requirements		
140	Infrared network adapter meets network adapter requirements	Required
141	Infrared device supports both FIR and SIR	Required
142	IrDA hardware reports a unique Plug and Play ID sufficient to support unattended driver installation	Required
IA-32 Wireless Networking Device Requirements		
143	Wireless networking media adapters meets network adapter requirements	Required
144	Wireless networking media adapters support wireless extensions to NDIS	Required
145	Wireless networking adapters support industry specifications	Required
IA-32 System Storage Device Requirements		
IA-32 Storage Device General Requirements		
146	Host controllers and devices support bus mastering	Required
147	System and Option ROMs support Int 13h Extensions on IA-32 BIOS boot system	Required
148	Block rewritable optical ATAPI device complies with SFF 8070i	Required
149	Controller and peripherals support media status notification	Required
150	Operating system recognizes the boot drive in a multiple-drive system	Required
150.1	IA-32 BIOS boot system uses CIP BIOS Boot 1.01 method to determine boot drive	Required
158	USB-based mass storage device complies with USB specifications	Required
159	IEEE 1394-based mass storage complies with 1394 OpenHCI 1.0	Required
160	Drivers for devices that use SBP-2 device command protocols follow Windows 2000 guidelines	Required
IA-32 SCSI Controllers and Peripherals		
161	System includes SCSI host controller and SCSI peripherals	Required for Servers running AS/DC
162	SCSI controllers with external connectors that can function as cluster nodes provide multi-initiator support	Required
163	Bus type is clearly indicated on connectors for all adapters, peripherals, cables, and terminators	Required

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164	Differential devices support DIFFSENS as defined in SPI-3 standard	Required
165	Automatic termination circuit and SCSI terminators comply with SCSI-3	Required
166	Terminator power is supplied to the SCSI bus, with over-current protection	Required
167	External connector complies with SCSI-2 or later	Required
168	Controller and peripherals implement SCSI data protection signal	Required
169	SCSI connections use keyed and shrouded connectors	Required
170	External devices provide SCSI-3 compliant termination	Required
171	SCAM support is not be present	Required
172	Hardware supports the STOP/START UNIT command as defined in the SBC specification	Required
173	STOP/START UNIT command can be used to decrease power consumption	Recommended
174	SCSI devices that support hot-plugging comply with Annex D of SPI-3	Required
IA-32 ATA Controllers and Peripherals		
175	System does not include ATA host controller and peripherals	Required for Servers running AS/DC
176	Dual ATA adapters use single FIFO with asynchronous access or dual FIFOs and channels	Required
177	ATA controller and peripherals comply with ATA/ATAPI-5 standard commands for features implemented and support Ultra-DMA (ATA/33, minimum)	Required
178	ATA controller and peripheral connections include Pin 1 cable designation with keyed and shrouded connectors	Required
179	ATAPI peripherals comply with ATA/ATAPI-5 standard commands for features implemented	Required
180	ATAPI devices support DEVICE RESET command	Required
181	ATA/ATAPI device supports ATA STANDBY command	Required
IA-32 Fibre Channel Controllers and Peripherals		
182	System includes Fibre Channel controller and peripherals	Recommended/ Optional for SOHO
IA-32 Erasable Disk Drives		
183	SCSI erasable drives support SCSI commands	Required
IA-32 CD and DVD Drives		
184	System includes CD or DVD drive or other method for installing the operating system	Required
IA-32 CD Drive Requirements		
185	CD drive provides 8x or higher performance	Required
186	CD drive is CD-Enhanced compatible	Required
187	CD drive supports specified logical and physical CD formats	Required
188	ATA/ATAPI CD drive complies with MMC-2	Required
189	CD drive supports multisession and compatibility forms of the READ_TOC command	Required
190	ATA/ATAPI CD changer meets MMC-2 standard	Required
IA-32 DVD Drive Requirements		

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191	DVD device provides 2 MB minimum transfer rate or better performance anywhere on the disk	Required
192	DVD drive meets minimum compatibility requirements	Required
193	DVD drive supports defect management	Required
194	DVD-Video playback, if present, meets DVD-Video playback requirements	Required
IA-32 Backup Devices		
195	System includes device for local backup	Recommended
196	Single-backup device meets minimum capacity requirements	20GB for Enterprise class-10GB all others
197	Backup device meets industry standards	Required
198	Driver integrated with Removable Storage Manager	Required
IA-32 CD Changers		
199	CD changer for seven or fewer discs meets MMC-2 standard	Recommended
IA-32 Tape and Optical Disk Changers		
200	SCSI changer and drive support auto-configuration	Required
201	SCSI tape and optical disk changers support SCSI commands	Required
IA-32 System Physical Design and Hardware Security Requirements		
IA-32 Physical Design Requirements		
202	Icons are provided for all external connectors	Required
203	All expansion slots in the system are accessible for users to insert cards	Required
204	System and device design include protected switches	Recommended
205	System design includes locking case	Recommended
206	System and device design include positive retention connectors	Recommended
207	If present on an IA-32 system, parallel port design provides sufficient space for connector assembly	Required
IA-32 Hardware Security Requirements		
208	C2 evaluation for hardware	Recommended
209	Peripherals follow hardware security recommendations	Recommended
IA-32 System Reliability, Availability, and Serviceability Requirements		
IA-32 Backup Hardware		
210	System includes integrated backup solution	Recommended
IA-32 Power Supply		
211	System includes UPS provided with system	Recommended

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212	System includes power supply protection using N+1 (extra unit)	Required for Enterprise class and systems running AS/DC- Recommended for all others
213	System supports replacement of power supplies	Required
214	System supports replacement of fans	Required
215	System includes local hot-swap power supply replacement indicators	Required for systems running AS/DC- Recommended for all others
IA-32 Fault-Tolerant Hardware		
216	System supports multiple hard drives	Required for systems running AS/DC- Recommended for all others
217	System includes intelligent RAID controller with adequate storage capacity	Required for Enterprise class systems and systems deploying MSCS Clustering
218	System supports at least one of RAID 1, 5, or 1/0	Required for Enterprise class systems and systems deploying MSCS Clustering
219	RAID support includes notification of failed drive	Required
220	RAID subsystem supports automatic replacement of failed drive	Required for Enterprise class systems and systems deploying MSCS Clustering

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221	RAID subsystem supports manual replacement of failed drive	Required for Enterprise class systems and systems deploying MSCS Clustering
IA-32 Serviceability Requirements		
222	IA-32 system includes protected forced dump switch or other mechanism for system diagnosis	Required for Enterprise class and systems running AS/DC- Recommended for all others
High Availability Requirements for IA-32 Systems		
223	System includes alert indicators for occurrence of failure	Required for systems running AS/DC- Recommended for all others
224	Hot-swappable drive includes a local disk drive replacement indicator	Required
225	System includes alert indicators for imminence of failure	Required for systems running AS/DC- Recommended for all others
IA-32 General Manageability Baseline Requirements		
227	Remote new system setup and service boot support uses DHCP and TFTP	Recommended
228	Expansion devices can be remotely managed	Recommended
IA-32 Manageability Component Instrumentation Requirements		
229	System supports Windows Hardware Instrumentation Implementation Guidelines	Required